(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 171 201**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **27.06.90**

(21) Application number: **85304903.9**

(22) Date of filing: **09.07.85**

(51) Int. Cl.[5]: **D 06 N 7/00**, B 32 B 11/10, B 32 B 17/04, B 32 B 27/32, B 32 B 27/34, B 32 B 27/36, B 32 B 31/10

(54) **Method for manufacturing carpet tiles having excellent dimensional stability.**

(30) Priority: **09.07.84 JP 142035/84**

(43) Date of publication of application:
12.02.86 Bulletin 86/07

(45) Publication of the grant of the patent:
27.06.90 Bulletin 90/26

(84) Designated Contracting States:
DE GB NL

(56) References cited:
CH-A- 617 304
GB-A-1 289 921
US-A-3 728 182
US-A-4 437 918
US-A-4 443 575

(73) Proprietor: **NIPPON OIL CO., LTD.**
1-3-12, Nishishimbashi Minato-ku
Tokyo (JP)

(72) Inventor: **Kajikawa, Teruo**
4-19-18, Ohyabe
Yokosuka-shi Kanagawa-ken (JP)
Inventor: **Yoshino, Toshio**
4-6-1, Iriya
Zama-shi Kanagawa-ken (JP)

(74) Representative: **Brown, John David et al**
FORRESTER & BOEHMERT Widenmayerstrasse 4/I
D-8000 München 22 (DE)

EP 0 171 201 B1

Courier Press, Leamington Spa, England.

Description

Background of the Invention

(1) Field of the Invention

This invention relates to a method for manufacturing carpet tiles exhibiting excellent dimensional stability with respect to change in ambient temperature.

(2) Description of the Prior Art

Carpet tiles are pieces of carpet in the shape of a square, rectangle, rhombus or the like or of a more complicated shape, having an area of, for example, 0.05 to 2 m^2. Such carpet tiles may be fitted next to each other to closely cover a floor. Carpet tiles have an advantage over ordinary carpets in that they may be easily laid on floor by merely placing the carpet tiles side by side and fixing them. Carpet tiles also have such merit that they can provide a variety of visual impressions by using different combinations of shape and color, and the repair thereof is easy. In cases where the carpet tiles are laid on the floor, it is required that they adhere sufficiently to the floor so that no portion thereof is slipped out from its appropriate position when one walks thereon. In this connection, carpet tiles are known which may be fixed by their own weight, such carpet tiles being designed to have a sufficient weight for fixability (self-fixing) by comprising a relatively thick backing material.

Backing materials for carpet tiles serve also for providing fiber-shedding prevention, shape retaining performance, fitness onto floor and other various properties to the carpet tiles.

A conventional carpet tile has generally such a construction in which a backing material is laminated on a carpet base material, and onto which a fabric backing is further attached, optionally, there is also such a case where an adhesive is used for fixing pile yarns of such carpet base material, or a case where no fabric backing is employed.

While conventional carpet tiles are ones having various advantages as described above, there is also such a disadvantage in that dimension of such a conventional carpet tile changes slightly with change in temperature due to turning of the seasons or rapid change in temperatures due to air-conditioner. Since carpet tile has hitherto self-fixing characteristic property by its own weight, such carpet tiles have been usually applied without utilizing any adhesive means.

For this reason, conventional carpet tiles have had such a disadvantage in that if there is a significant change in temperature, considerable deformation is observed in a large area for application, even though there is a slight change in the dimension of a piece of carpet tile. In other words, when temperature dropped remarkably, gaps appear between the respective carpet tiles due to slight shrinkage of them, so that it mars the beauty thereof, or feeling in case of walking on such shrunk carpet tiles becomes uncomfortable because these carpet tiles may be slipped out of place one another at the time of such walking. On the contrary, when temperature rose significantly, there is also such a case where bluges (swellings) are produced on the carpet tiles due to swelling thereof. It may be said that the most significant disadvantage of carpet tile is dimensional change thereof with change in temperature as described above, so that immediate solution of such problem has been required.

Object of the Invention

It is an object of the present invention to eliminate the above-mentioned disadvantages involved in conventional carpet tiles and to provide such carpet tiles having excellent dimensional stability.

Summary of the Invention

The present invention relates to a method for manufacturing carpet tiles having excellent dimensional stability, which method comprises the steps of:

(a) laminating a glass recticulated fabric base having a small thermal coefficient of linear expansion, 20% or more of opening ratio and a unit weight within a range of from 10 to 1,000 g/m^2 onto a carpet base material so as to be in contact with the whole back surface of the carpet base material and

(b) applying a backing material prepared from a composition containing a thermoplastic material as the major component selected from asphalt, polyolefin and olefin-polar monomer copolymer at a temperature in the range of from 100 to 250°C by means of a coater onto the glass reticulated fabric base, and

(c) optionally further laminating a fabric backing onto the backing material.

Brief Description of the Drawing

Figure 1 is a schematic view illustrating an example of the method for manufacturing carpet tiles according to the present invention.

Detailed Description of the Invention

The carpet base materials in the present invention are not specifically defined, but they may be woven carpets, knitted carpets, tafted carpets, needle-punched carpets and the like prepared from natural fibers such as wool, cotton, hemp or the like, synthetic fibers such as polypropylene, polyester, polyamide, polyacrylate, polyvinylidene chloride or the like, and other fibrous materials of flat yarn, and among others

tafted carpets and needle-punched carpets can be particularly preferably used. Besides, such materials obtained by subjecting these carpet base materials to precoating treatment of a latex system, a hot-melt adhesive of ethylene-vinyl acetate copolymer system, and a low-density polyethylene film may also be utilized.

The glass reticulated fabric base used in the present invention is one having a small thermal coefficient of linear expansion (10^{-5}/°C or less, and preferably 10^{-6}/°C or less) and an opening ratio required for passing a backing material therethrough. Such fabric bases include woven fabrics obtained through plain, twill, figure, or leno weaving etc of bundled yarn, fabrics which are prepared from bundled yarn by binding the same in network without weaving, and nonwoven fabrics prepared by dispersing fibers at random with a uniform thickness and binding the fibres with the use of a binder. Particularly suitable for the present invention are plain weave fabric and fabric prepared by binding bundled yarn with a binder in network without any weaving, and one, two or more pieces of such fabrics are utilized in lying one upon another.

An opening ratio of such fabric base is 20% or more and preferably 25% or more, having a unit weight within a range of from 10 to 1,000 g/m^2, and a preferable diameter of such opening is 1.0 mm or more.

The backing material used in the present invention is prepared from a composition containing a thermoplastic material as the major component. Examples of such thermoplastic material include asphalt such as natural asphalt, petroleum asphalt or the like, polyolefins such as polyethylene, polypropylene, ethylene-propylene copolymer, ethylene-butene copolymer and the like, olefin-polar monomer copolymers such as ethylene-vinyl acetate copolymer, ethylene-acrylic ester copolymer and the like, and chlorinated polymers such as polyvinyl chloride, polyethylene chloride and the like.

In case of using asphalt as the backing material in the present invention, with 50—90% by weight of the asphalt may be incorporated 10—50% by weight of polyolefin such as polyethylene, polypropylene, ethylene-propylene copolymer, ethylene-butylene copolymer or the like, ethylene-polar monomer copolymer such as ethylene-vinyl acetate copolymer, ethylene-acrylic ester copolymer or the like, chlorinated polymer such as polyvinyl chloride, chlorinated polyethylene or the like, or synthetic or natural rubber such as styrene-butadiene (random, block) copolymer, styrene-isoprene (random, block) copolymer, butyl rubber, isoprene rubber, chloroprene rubber or the like, and, if necessary, an inorganic filler.

Furthermore, in case of using a polyolefin, with 50—95% by weight of the polyolefin may be incorporated 5—50% by weight of wax, a low molecular weight polyolefin, petroleum resin and inorganic filler. Furthermore, in the case where ethylene-polar monomer copolymer system material is employed, with 10—90% by weight of the copolymer may be incorporated 10—85% by weight of an inorganic filler, 0—20% by weight of a softner and/or a plasticizer which is liquid state in the normal temperature.

In the case where a chlorinated polymer is employed, with 10—90% by weight of the chlorinated polymer may be incorporated 5—80% by weight of a plasticizer and 0—80% by weight of an inorganic filler.

If an asphalt, polyolefin, or ethylene-polar monomer copolymer system material is utilized in the present invention, the backing material may be prepared by means of kneader, Banbury mixer, single or twin screw kneading extruder. The resulting composition is applied as first and second backing materials in such that the total amount of them becomes 1.5—8.0 kg/m^2, and preferably 2.0—6.0 kg/m^2. When such total amount of the backing material is less than 1.5 kg/m^2, self-fixing stability of the resulting carpet tile by its own weight becomes poor so that it is not suitable. On the other hand, when the total amount of the backing material is higher than 8.0 kg/m^2, application for laying the resulting carpet tile on a floor becomes difficult and economically disadvantageous.

Furthermore, in case of a chlorinated polymer, paste is preparerd from polyvinyl chloride plasticizer (e.g., DOP) and an inorganic filler, and such paste may be applied to a carpet base material with an amount of 1.5—8.0 kg/m^2.

The fabric backings of the present invention may be woven fabrics, bound fabrics or nonwoven fabrics prepared from polyester, polyamide, polypropylene, or glass fibers, and those having a unit weight of 10—500 g/m^2 and preferably 15—400 g/m^2 may be utilized as occasion demands. The case where such fabric backings are required is one where backing material is a composition containing asphalt as the major component, or one where there is required to more precisely control dimensional change of carpet tile in order that such carpet tiles are used in such a place where change in temperature is particularly remarkable. In the case where woven, bound or nonwoven fabric prepared from glass fiber is used as the fabric backing, it is necessary for selecting such fabric backing having a lower unit weight than that of a reticulated fabric base produced from said glass fiber. If fabric backing of a high unit weight is selected, there is such a case where the resulting carpet tile is curved towards the carpet base material so that there is in danger of stumbling and a fear of spoiling the beauty.

Next, the method for manufacturing carpet tiles having excellent dimensional stability according to the present invention will be described hereinbelow.

Figure 1 is a schematic view illustrating an example of the method for manufacturing carpet tiles in accordance with the present invention wherein a glass reticulated fabric base 5 guided from a reticulated fabric base supplying section 4 is laminated on a carpet base material 1 withdrawn from a carept base material supplying section 2 and traveled by means of a conveyor 3 so as to be in contact with the whole surface of the carpet base material 1, then a backing material 6 made of a composition (except a pasty

composition of polyvinyl chloride) containing a thermoplastic material as the major component is subjected to T-die extrusion at a temperature of 100—250°C, such backing material extruded is applied to the resulting composite material of the carpet base material 1 and the fabric base 5 with an amount of 1.5—8.0 kg/m^2 at a temperature of 100—250°C by means of a doctor blade or a coater 7 such as calender roll coater or the like, thereafter a fabric backing 9 guided on the upper surface of said backing material 6 in parallel thereto from a fabric backing supplying section 8 is optionally laminated thereon by the use of a pressure rollers 10 to form a laminated carpet sheet material 11 having prescribed thickness and properties, further the carpet sheet material 11 is passed through a cooling means 12 in the following processes, and finally a desired carpet tile 14 is obtained through a cutting means 13.

In such an instance where the backing material is made of a composition containing polyvinyl chloride, paste prepared from polyvinyl chloride, a plasticizer and an inorganic filler is homogeneously applied to the composite material of said carpet base material and riticulated fabric base with an amount of 1.5—8.0 kg/m^2 at ordinary temperature by utilizing a doctor blade, if necessary, a fabric backing is laminated thereon, and the resulting laminated material is heated at 150—220°C for 20—5 minutes to perform gelation of such material, thereby obtaining an integrated carpet sheet material. Alternatively, a pasty composition of polyvinyl chloride system may be homogeneously spread over a fabric backing or conveyor, on which a reticulated fabric base and a carpet base material are laminated, and they may be similarly heated to perform gelation thereof. Then, the resulting carpet sheet material is cut out in a prescribed dimension to obtain carpet tiles.

It has been found that when the glass reticulated fabric base used in the present invention is inserted in the backing material so as to be in contact with the carpet base material, the resulting carpet tile has excellent dimensional stability. More specifically, the reticulated fibres used in this invention has a very small thermal coefficient of linear expansion and which is far smaller than those of carpet base materials, backing materials and fabric backings which have been hitherto utilized for carpet tiles. Thus, when the glass reticulated fabric base of the present invention is employed in combination with other materials, dimensional change of the resulting carpet tile becomes very small in respect of change in temperature. On one hand, a conventional backing material to be used for carpet tiles has been utilized in such a manner that the backing material is heat-fused at a temperature of 100—250°C to form a sheet and the sheet thus obtained is employed in combination with a carpet base material and a fabric backing. In these circumstances, the most remarkably set at room temperature is the above conventional backing material. For this reason, it is very useful for improving dimensional stability of carpet tile that the reticulated fabric base according to the present invention is in contact with such backing material as described above. Another reason for utilizing the glass reticulated fabric base in the present invention resides in that a backing material is allowed to be contact with a carpet base material through the network of the reticulated fabric base. In this respect, if such a fabric base having no network therein is used, a backing material cannot be served for inserting the fabric base thereinto, otherwise the backing material is divided in two layers for its use. In the glass reticulated fabric base according to the present invention, however, there is an advantage in the point described above without any division of the backing material.

Examples

The present invention will be described in more detail hereinbelow in conjunction with examples and comparative examples.

Examples 1—7

Various carpet tiles were prepared by such as manner that a reticulated fabric base prepared from glass fiber was superposed on the back of a tafted or needle-punched carpet, to which each of various backing materials was applied as shown in Table 1, and a fabric backing was optionally laminated thereon.

With respect to these various carpet tiles, each ratio of dimensional change was determined in accordance with such a way that changes in dimension of a carpet tile were measured in each atmosphere where the temperatur is higher or lower by 40°C than basis room temperature of 20°C. The results are shown in Table 1, and as is apparent therefrom, the ratios of dimensional change were very small and it meant a good dimensional stability. Thus, carpet tiles having no problem from practical point of view were obtained in accordance with the present invention.

TABLE 1

Example	1	2	3	4	5	6	7
Carpet Base Material							
Type	Tafted Carpet	Needle-Punched Carpet	Tafted Carpet	Tafted Carpet	Needle-Punched Carpet	Tafted Carpet	
Yarn Material	Acrylic	PP	Nylon	PP	PP	Wool	
Fabric Base Material	PP Woven Fabric	PP Nonwoven Fabric	Polyester Non-Woven Fabric	Polyester Non-woven Fabric	PP Nonwoven Fabric	Polyeser Non-woven Fabric	←
Unit Weight (g/m^2) on Fabric Base	120	(total) 1,000	100	100	(Total) 800	100	
(a) Glass Reticulated Fabric Base							
Weave	Plain Weave	Nonwoven Fabric	Plain Weave	Plain Weave	Bound Reticulated Fabric without Weaving	Plain Weave	Bound Reticulated Fabric without Weaving
Unit Weight (g/m^2)	225	60	55	340	73	760	32 × 2 pieces
Thickness of Bundled Yarn (mm)	0.30	(Aperture having 5 mm diameter, 125/square inch (6.45 cm^2))	0.08	0.36	0.20	1.0	0.20
Density of Bundled Yarn (number/inch) (number/2.54 cms)	16		20	16	10	18	5 × 2 pieces
Opening Ratio	about 6/7	about 2/3	about 19/20	about 5/6	about 14/15	about 1/3	about 14/15

EP 0 171 201 B1

Example	1	2	3	4	5	6	7
(b) Backing Material Type	Asphalt System	LDPE System	EVA System	EVA System	EEA System	PVC System	Asphalt System
Composition (%)	40—60 Straight Aspahlt 70 EVA 30 (VA 8%, MI 15)	(LDPE 80 (MI 40) Calcium Carbonate 20)	(EVA 40 (VA 26%, MI 8) DOP 10 Calcium Carbonate 50)	(EVA 30 (VA 28%, MI 4) DOP 10 Calcium Carbonate 60	(EEA 40 (EA 20%, MI 4) Processing Oil Calcium Carbonate 50)	PVC 20 DOP 25 Calcium Carbonate 55)	(10—20 Blown Asphalt 75 TPR 25
Unit Weight (Kg/m^2)	3.0	3.5	4.0	5.0	4.0	4.5	3.0
(c) Fabric Backing Material	Polyester Nonwoven Fabric	None	Polyester Nonwoven Fabric	Glass Non-Woven Fabric	None	Polyester Nonwoven Fabric	Nylon Non-Woven Fabric
Unit Weight (g/m^2)	90		70	25		100	120
Outline of Manufacturing Method	Heat-fused at 160°C, Lamination by Doctor Blade Coating	Heat-fused at 200°C, Lamination by T-die Extrusion	←	←	←	Lamination by Doctor Blade Coating. Heating at 180°C for 15 min. to perform Gelation	Heat-fused at 180°C, Laminated by Doctor Blade Coating
Dimensional Stability							
Ratio of Dimentional Change (%)							
Rise 40°C							
Length	+ 0.06	+ 0.10	+ 0.07	+ 0.04	+ 0.09	+ 0.05	+ 0.08
Breadth	+ 0.07	+ 0.14	+ 0.07	+ 0.05	+ 0.09	+ 0.06	+ 0.09
Drop 40°C							
Length	− 0.08	− 0.11	− 0.08	− 0.05	− 0.09	− 0.06	− 0.08
Breadth	− 0.08	− 0.15	− 0.09	− 0.05	− 0.10	− 0.07	− 0.10

Comparative Examples 1—5

Various carpet tiles were prepared by such a manner that each of various backing materials shown in Figure 2 was applied to the back of a taffetized carpet without employing a reticulated fabric base prepared from glass fiber, and a fabric base prepared from glass fiber, and a fabric backing was optionally laminated thereon.

With respect to these various carpet tiles, each ratio of dimensional change was determined in accordance with such a way that changes in dimension of a carpet tile were measured in each atmosphere where the temperature is higher or lower by 40°C than basis room temperature of 20°C. The results are shown in Table 2, and as if apparent therefrom, the ratios of dimensional change were very large so that there might be problems from practical point of view. Each raw material for the backing materials will be abbreviated herein as follows.

Ethylene-vinyl acetate copolymer:	EVA
Ethylene-ethyl acrylate copolymer:	EEA
Polypropylene:	PP
Low-density polyethylene:	LDPE
Polyvinyl chloride:	PVC
Dioctyl phthalate:	DOP
Styrene-butadiene block copolymer:	TPR

TABLE 2

Comparative Example	1	2	3	4	5
Carpet Base Material Type Yarn Material Fabric Base Material Unit Weight (g/m^2) on Fabric Base	Tafted Carpet Nylon Polyester Nonwoven Fabric 100	←	←	←	←
(a) Glass Reticulated Fabric Base	None	←	←	←	←
(b) Backing Material Type Composition (%) Unit Weight (kg/cm^2)	Asphalt system (40—60 Straight Asphalt 70 EVA 30 (VA 8%, MI 15)) 3.0	LDPE System (LDPE (MI 10) 80 Calcium Carbonate 20) 3.5	EVA System (EEA 40 (VA 26% MI 8) DOP 10 Calcium Carbonate 50) 4.0	EEA System (EEA 40 (EA 20%, MI 4) DOP 10 Calcium carbonate 50) 4.0	PVC System (PVC 20 DOP 25 Calcium Carbonate 55) 4.5

Comparative Example	1	2	3	4	5
(c) Fabric Backing					
Material	Polyester Nonwoven Fabric	None	None	Polyester Non-woven Fabric	Polyester Non-woven Fabric
Unit Weight (g/m^2)	70			50	50
Outline of Manufacturing Method	Heat-fused at 170°C Lamination by Doctor Blade Coating	Heat-fused at 200°C Lamination by T-die Extrusion	Heat-fused at 200°C Lamination by T-die Extrusion	Heat-fused at 190°C Lamination by T-die Extrusion	Lamination by Doctor Blade Coating, Heating at 180°C for 15 min. to perform Gelation
Dimensional Stability					
Ratio of Dimensional Change (%)					
Rise 40°C					
Length	+ 0.40	+ 0.43	+ 0.44	+ 0.42	+ 0.40
Breadth	+ 0.47	+ 0.61	+ 0.60	+ 0.50	+ 0.49
Drop 40°C					
Length	− 0.40	− 0.47	− 0.45	− 0.44	− 0.42
Breadth	− 0.50	− 0.62	− 0.60	− 0.55	− 0.50

Claims

1. A method of manufacturing carpet tiles having excellent dimensional stability, which method comprises the steps of:

(a) laminating a glass reticulated fabric base having a small thermal coefficient of linear expansion, 20% or more of opening ratio and a unit weight within a range of from 10 to 1,000 g/m² onto a carpet base material so as to be in contact with the whole back surface of the carpet base material and

(b) applying a backing material prepared from a composition containig a thermoplastic material as the major component selected from asphalt, polyolefin and olefin-polar monomer copolymer at a temperature in the range of from 100 to 250°c by means of a coater onto the glass reticulated fabric base, and

(c) optionally further laminating a fabric backing onto the backing material.

2. A method according to Claim 1, wherein the carpet material is a tafted or needle-punched carpet.

3. A method according to Claim 1 or 2, wherein the fabric backing is a woven, bound or nonwoven fabric prepared from a polyester, polyamid, polypropylene or glass fiber and has a unit weight within a range of from 10 to 500 g/m².

Patentansprüche

1. Verfahren zur Herstellung von Teppichplatten mit einer ausgezeichneten Formbeständigkeit, gekennzeichnet, durch folgende Schritte:

a) Laminieren einer glasvernetzten Stoffgrundlage mit einem kleinen Wärmekoeffizienten der Längsdehnung, 20% oder mehr Öffnungsverhältnis und einem spezifischen Gewicht in einem Bereich von 10 bis 1000 g/m² auf ein Teppich-Grundmaterial, so daß es mit der gesamten Rückenfläche des Teppich-Grundmaterials in Kontakt steht, und

b) Aufbringen eines Verstärkungsmaterials, das aus einer Zusammensetzung hergestellt ist, die als Hauptbestandteil ein thermoplastisches Material enthält, das aus Asphalt, Polyolefin und Copolymer aus Olefin und polarem Monomer ausgewählt ist, bei einer Temperatur im Bereich von 100 bis 250°C mittels einer Auftragmaschine auf die glasvernetzte Stoffgrundlage und

(c) fakultativ weiteres Laminieren einer Stoffverstärkung auf das Verstärkungsmaterial.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das Teppichmaterial ein getafteter oder vernadelter Teppich ist.

3. Verfahren nach Anspruch 1 oder 2, daduch gekennzeichnet, daß die Stoffverstärkung ein gewebter, eingefaßter oder Vliesstoff ist, der aus Polyester, Polyamid, Polypropylen oder Glasfaser hergestellt ist und ein spezifisches Gewicht in einem Bereich von 10 bis 500 g/m² besitzt.

Revendications

1. Procédé de fabrication de tapis en dalles possédant une excellente stabilité dimensionnelle, procédé qui consiste:

(a) à laminer une étoffe de base de verre réticulé présentant un faible coefficient thermique de dilatation linéaire, un rapport d'ouverture de 20% ou plus et un poids unitaire compris entre 10 et 1000 g/m² sur une matière des base de tapis de manière à la mettre en contact avec la totalité de l'envers de la surface de la matière de base de tapis, et

(b) à appliquer une matière de soutènement préparée à partir d'une composition contenant une matière thermoplastique à titre de composant principal choisie parmi l'asphalte, une polyoléfine et un copolymère oléfine/monomère polaire, à une température comprise entre 100 et 250°C au moyen d'un dispositif de revêtement sur l'étoffe de base de verre réticulé, et

(c) facultativement à laminer encore un support d'étoffe sur la matière de soutènement.

2. Procédé selon la revendication 1, dans laquel la matière du tapis est un tapis tufté ou un tapis aiguilleté.

3. Procédé selon la revendication 1 ou 2, dans lequel le support d'étoffe est un étoffe tissée, liée ou un tissée préparée à partir de fibres de polyester, polyamide, polypropylène ou verre et présentant un poids unitaire comprise entre 10 et 500 g/m².

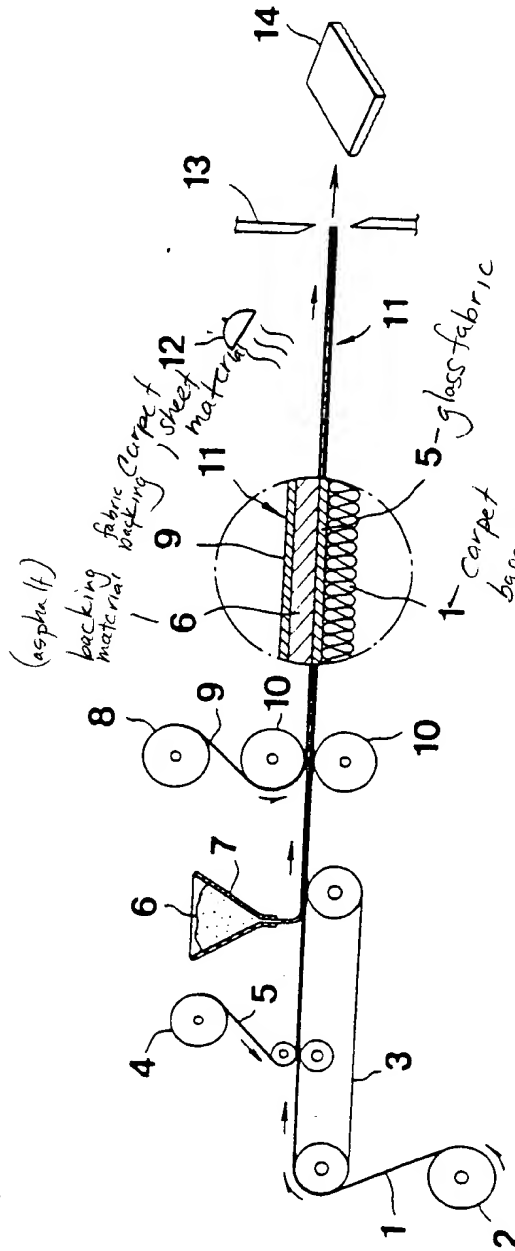

FIG.1

102-19 & 20